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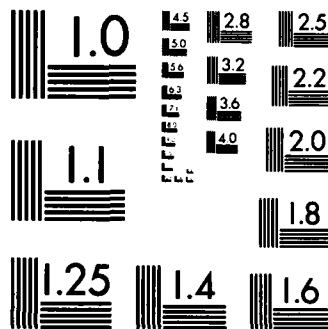
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## Annual Report

K-0387

Contract: N00014-84-K387 [Task NR 372-063]

Title: Two-dimensional Electrons

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 716-636-2007

Period: June 1, 1984-May 31, 1985

## Report:

a. Papers Submitted for Publication

- A. Isihara, Two-Dimensional Electrons in Strong Magnetic Field, Proc. Internat. Symp. on Selec. Topics in Stat. Mech.

The variation of the chemical potential with electron density (filling factor) and its relation with the quantized Hall effect was discussed.

- A. Isihara, Low-Temperature Properties of Two-Dimensional Electrons. Proc. 20th Anniv. Internat. Research Workshop on Condensed Matter, Physica Scripta

A summary of our recent work leads to an integral equation which has a solution representing the quantized Hall effect.

- A. Isihara and Y. Shiwa, Effects of Level Broadening on the Magnetothermal Oscillations in Two-Dimensional Electron Systems, J. Phys. C: Solid State

By a method which modifies Dingle's original approach to broadening in three dimensions, we have developed a very comprehensive theory of broadening effects on the magnetothermal effect in two-dimensional electron systems. It is shown that the linear electronic specific heat disappears in strong magnetic fields if Landau levels are not broadened. Thus, the amplitude of the magnetothermal oscillations is very sensitive to broadening, and this amplitude effect can be used to determine the density of states. The period of oscillation is still unaffected by broadening and can be used to determine the effective Bohr magneton.

b. Papers Published in Refereed Journals

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- A. Isihara and Y. Shiwa, Magnetothermal Oscillations in a Two-Dimensional Electron System, J. Phys. C: Solid State Phys. 17, 5705 (1984).

A rigorous analytical treatment with all relevant explicit formulae for the magnetothermal oscillations in two-dimensional electron systems is given, thereby our important conclusions such as the constancy of the period of oscillation and the reason why the effect is significant in two dimensions in contrast to three dimensions are presented explicitly.

Gornik confirmed at the San Francisco meeting that the effect was indeed large. Unfortunately, he missed our first paper which preceded Zawadzky's work which was entirely numerical.

- A. Isihara and Y. Nakane, Elementary Excitations and Energy Dispersion in TTF-TCNQ, Proc. Internat. Conf. on Phys. and Chem. of Low-Dimen. Syn. Conductors, Abano Terme, Molec. Crys. Liq. Crys. 120, 85 (1984).

One-dimensional conductors such as TTF-TCNQ are attracting considerable attention for their interesting conductivity and also for practical applications such as for batteries. A polaron effect on the plasmon dispersion is discussed and the experimental data of Ritsko et al are analyzed. Both one- and two-band models show some deviations, supporting some other mechanism such as polaron formation.

- A. Isihara and Y. Nakane, Magnetoconductivity of 2D Conductors, Proc. Internat. Conf. on Phys. and Chem. of Low-Dimen. Syn. Conductors, Abano Terme Molec. Crys. Liq. Crys. 121, 169 (1984).

In consideration of mixing of low-lying Landau levels, the magnetoconductance of two-dimensional electrons is evaluated. The results agree qualitatively in shifting and broadening with the data of the Bell group.

- Y. Shiwa and A. Isihara, Memory Function for Cyclotron Resonance of Two-Dimensional Electron Systems, Solid State Commun. 53, 519 (1985).

As indicated above and also noticed in our recent work (A. Isihara and M. Mukai, Phys. Rev. B 28, 4842 (1983)), the anomalous shifting and narrowing in the cyclotron resonance of two-dimensional electron systems needed theoretical explanation. We have shown that with strong feedback of electron correlations to density-density correlations both shifting and narrowing can be explained when the Landau level filling factor  $\nu$  is larger than 1. Actually, we have shown that the resonance phenomena are characterized not only by this filling factor but by its combination with the density parameter  $r_s$  which measures the Coulomb effect:  $(2/g_d)r_s \nu^{1/2}$ , where  $g_d$  is degeneracy. The region of  $\nu < 1$  requires still more work, as in the case of quantized Hall effect. The role played by this new theoretical parameter has yet to be seen experimentally, but there are some indications already that the filling factor  $\nu$  alone is inadequate to describe the resonance.

- A. Isihara and Y. Shiwa, Quantum Oscillations of 2D Electron Systems,  
Proc. Internat. Conf. Low Temp. Phys. LT-17, Part II, p. 871 (1984).

Theoretical predictions are made of possible experimental observation of Coulomb effects on the dHvA oscillations of 2D electron systems and also on the magnetothermal effect in the same systems. A very important point where the ground state energy changes its sign is associated with a change in the oscillating pattern of the dHvA effect.

c. & d. Books Submitted for Publication or Published none

e & f. Patent Filed or Granted none

g. Invited Presentations at Scientific Conferences

- A. Isihara, Low Temperature Properties of Two-Dimensional Electrons  
20th Anniversary International Research Workshop on Condensed Matter,  
Trieste, June 25-June 29, 1984.

- A. Isihara, Two-Dimensional Electrons in Strong Magnetic Field  
Internat. Symp. on Selected Topics in Statistical Mechanics, Agu. 22-  
Aug. 26, 1984.

h. Contributed Contributions at Scientific Conferences

- A. Isihara and Y. Nakane, Elementary Excitations and Energy Dispersion in  
TTF-TCNQ, Internat. Conf. on the Phys. & Chemistry of Low-Dim. Syn.  
Metals, Abano Terme, June 17-June 22, 1984.

- A. Isihara and Y. Nakane, Magnetoconductivity of 2D Conductors, *ibid.*

- A. Isihara and Y. Shiwa, Quantum Oscillations of 2D Electrons in Strong  
Magnetic Field, Internat. Conf. on Low Temp. Phys. LT-17, Karlsruhe,  
Aug. 15- Aug. 22, 1984.

i. Honors/Awards/Prizes none

Author	Isihara, Y.
Title	Quantum Oscillations of 2D Electrons in Strong Magnetic Field
Journal	Proc. Internat. Conf. Low Temp. Phys. LT-17, Karlsruhe, Aug. 15-22, 1984
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